though more or less intermediate in their characters, rarely afford any evidence of reversion. It thus appears that, notwithstanding the "swamping effects of intercrossing," the offspring of quite distinct varieties sometimes afford no evidence of reversion, and, further, that Galton's law of heredity (which teaches that the intermediate and remote ancestors together contribute one-half of the total heritage of the average offspring) does not appear to hold in the case of highly prepotent animals. In dealing with the second question, experiments are first described in support of the view that there may be complete, or all but complete, reversion to comparatively recent ancestors. (*a*) A blue and white fantail (a cross between a white fantail and a dark blue cross-bred fantail), when mated with a blue fantail, invariably produces pure white fantails, identical, as far as external characters go, with their grandsire. (*b*) A smooth-coated white rabbit (a cross between an Angora and a smooth-coated white buck), mated with a smooth-coated and almost white doe (the granddaughter of a Himalaya rabbit), produced a litter of three, one of which is the image of the mother, one is an Angora like the grandmother, while the third is a Himalaya (with the characteristic black ears and muzzle and dark grey feet and tail) like the great grandmother.

The following experiment supports the view that there may be reversion to intermediate ancestors:—A Dalmatian dog crossed with a well-bred sable collie produced three pups, which closely resemble young pointers—these pups, with their white ground colour and four or five yellowish-brown patches, in all probability reproduce fairly accurately the intermediate ancestors of the Dalmatian sire. This experiment also suggests that if prepotent ancestors occur along the route which any given variety has travelled, reversion may be at any point abruptly arrested. The remaining experiments detailed afford evidence of more or less complete reversion to comparatively remote ancestors: (*a*) An Indian game Dorking cock, crossed with a dark bantam hen, produced, amongst other birds, a cockerel almost identical with a jungle fowl. It not only resembles *Gallus bankiva* in form and colour, but also in being extremely shy and (unlike the Dorking-like members of the same brood) in its habit of flying away for a considerable distance when suddenly disturbed. (*b*) The zebra-horse hybrids hitherto bred are in their markings very unlike their zebra parent. When the sire or dam is a Burchell zebra, the hybrids in the arrangement of their stripes are not unlike the Somali zebra (*Equus grevyi*), which is, in all probability, in its decoration, the most primitive of all the living zebras. The zebra ♂-horse ♀ hybrids (*Zebrules*), bred by the author at Penycuik, and the horse ♂-zebra ♀ hybrids (*Zebrinnies*), bred at Theobald's Park, Herts, by Lady Meux, differ from the Burchell zebra parents, and agree with the Somali zebra in having (1) rounded instead of pointed arches on the forehead; (2) more than twelve cervical stripes; (3) numerous stripes across the loins and croup—instead of five or six broad oblique stripes—and (4) in having the mane extending some distance beyond the withers.

In one of the Penycuik hybrids there are two sets of stripes over the hind quarters. In this hybrid the more pronounced stripes seem to have been inherited through the zebra parent, while the less distinct, which run in a different direction, have in all probability been inherited through the horse parent. This view is supported by the markings usually found in zebra-ass hybrids, in which the dorsal and shoulder stripes and the bars across the legs are, without doubt, inherited from or through the donkey parent, while the majority of the other markings are probably transmitted by the zebra. (*c*) Mules and hinnies are often more richly striped than their parents; *e.g.* a hinny recently obtained at Penycuik by crossing a light grey she-ass with a bay Welsh pony has, in addition to dorsal and shoulder stripes, distinct bars across the legs—there are no leg bars in either of the parents. Moreover, this hinny is of a yellowish brown colour, and in many ways seems more primitive than either of its parents. (*d*) The nearest approach to complete reversion has hitherto been obtained by crossing pigeons. Darwin, by crossing a barb-fantail with a barb-spot, produced a bird "which was hardly distinguishable from the wild Shetland species."[1]

Referring to this experiment, Weismann says that Darwin devoted his attention to the coloration of the species, and failed to state whether there was complete reversion, *i.e.* a complete agreement in form as well as in colour of the barb-fantail-spot with the wild rock pigeon. By way of settling whether in the case of pigeons complete, or all but complete reversion occurs, the author first crossed an "owl" with an "archangel" pigeon, and then mated the cross-bred bird with a pure white fantail. The owl-archangel cross had neither the frill, short beak, or short round head of the owl, nor yet the crest or bronzed black colour of the archangel. The owl-archangel-fantail cross is almost identical in colour, size, and form with the Indian wild rock pigeon. The only essential difference is in the tail, for though there are twelve feathers (in the fantail parent there are thirty), the tail is slightly arched; this is the only suggestion of the white fantail sire.

The author believes that the experiments recorded afford substantial support to the reversion hypothesis.

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[1] "Animals and Plants," vol. i. p. 210.

MASSIVE LAVA FLOWS ON THE SIERRA NEVADA.

AN account of "Some Lava Flows of the Western Slope of the Sierra Nevada, California," is given by Mr. F. Leslie Ransome, in *Bulletin* No. 89 of the United States Geological Survey, 1898. The area is described as having been worn down to a rough peneplain during the interval between the close of the Jura-trias and the beginning of the Miocene period. The rocks upon which this somewhat uneven peneplain has been carved are those of the so-called "Bed-rock series" of the Gold Belt, and are of Jura-trias and earlier age. They consist on the lower slopes (or foothill region) of clay-slates, schists, limestones, quartzites and various igneous rocks; and on the higher slopes mainly of gneissic and granitic rocks.

Volcanic eruptions began during the Miocene period, and, accompanied by elevation and tilting of the peneplain, lasted to the end of the Pliocene. The first eruptions were rhyolitic, followed by the laying down of a great cloak of andesitic breccias and tuffs. The deposition of auriferous gravels both preceded and accompanied the piling up of volcanic materials. Thus the earlier accumulation of andesitic breccias and tuffs was interrupted by at least one period of considerable erosion during which a large stream, the predecessor of the present Stanislaus river, cut through the volcanic cover into the Bed-rock series along the greater part of its course. During subsequent eruptions massive flows of lava extended over limited areas, displacing the stream before mentioned, and following generally the course of the Stanislaus river, while andesitic breccias and tuffs were spread for hundreds of square miles over the western slope of the Sierra. Other more restricted flows of lava followed, and the volcanic period was brought to an end by fresh andesitic eruptions, as shown by breccias which rest on the massive flows of lava. To these lavas the author applies the name of *Latite*, derived from the Italian province of Latium, where there occur in abundance rocks closely related to those he describes. Mineralogically the Sierra Nevada latites are nearly allied to ordinary andesites, but chemically they stand between the andesites and trachytes. They correspond to the plutonic monzonites of Brögger, and represent the effusive forms of the magma. The author would use the term latite in a broad sense, and to include such varieties as toscanite, vulsinite, and ciminite, which have been described by Washington in his studies in the Italian volcanic regions.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—At the 196th meeting of the Junior Scientific Club, on February 3, Mr. F. N. A. Fleischmann exhibited a heart-shaped twin of calcite, and Mr. H. B. Hartley gave an exhibit of Japanese sword blades, explaining at the same time the mode of manufacture that has been used since the fourteenth century in Japan. Mr. M. Burr read a paper on "grasshoppers."—The officers for this term are—President, Mr. F. Soddy (Merton); Chemical Secretary, Mr. H. B. Hartley (Balliol); Biological Secretary, Mr. A. G. Gibson (Ch. Ch.); Treasurer, Mr. W. E. Blackall (Non-Collegiate); Editor, Mr. H. E. Stapleton (St. John's); Committee, Mr. F. N. A. Fleischmann (Magdalen), Mr. E. Gurney (New College), and Hon. F. R. Henley (Balliol). At the next meeting of the Club (Wednesday, February 15), Prof. Odling, F.R.S., will read a paper on "Chemical

Theories under discussion about the year 1850—some personal reminiscences."

CAMBRIDGE.—The General Board of Studies has received offers from Sir Walter Gilbey, the Board of Agriculture, certain County Councils, and the Drapers' Company of sums amounting to over 2000*l.* a year for the next ten years for the support of a department of Agricultural Science in connection with the University. The Board proposes that a Professorship of Agriculture should be founded, together with a Board of Agricultural Studies to whom the administration of the department will be entrusted; and recommend that the offers be gratefully accepted by the University. Detailed proposals for the organisation of the department will be hereafter submitted, provided the general scheme is approved by the Senate. It is estimated that, during the ten years for which in the first instance the department will be established, its operations can be carried on without entailing any financial responsibility on the University Chest.

Mr. B. L. Cohen, M.P., has promised 3000*l.* to the University Benefaction Fund, and a number of smaller donations have been received as a result of the formation of the Cambridge University Association.

CAPTAIN PARTINGTON has given 2000*l.* towards the cost of building the new physical laboratory of Owens College, Manchester.

PROF. CLEVELAND ABBE is reported by *Science* to have given to the Johns Hopkins University his valuable collection of books, journals and pamphlets relating to meteorology.

THE views of several American naturalists on advances in methods of teaching were discussed at the recent meeting of American Naturalists and Affiliated Societies, and are printed in *Science* of January 20. The subjects dealt with are: zoology, by Prof. E G. Conklin; anatomy, Prof. G. S. Huntington; physiology, Prof. W. T. Porter; psychology, Prof. H. Münsterberg; anthropology, Dr. Franz Boas; botany, Prof. W. F. Ganong.

A COPY of the Tōkyō Imperial University Calendar for the year 1897–98 has been received. At the end of the Calendar is a long list of papers published since 1887 in the Journals of the Medical and Science Colleges, the Memoirs of the Literature College, and the Bulletins of the Agriculture College. Since the Calendar went to press, the president of the University, Prof. Masakazu Toyama, has been appointed Minister of State for Education, and has been succeeded by Prof. Dairoku Kikuchi, M.A. (Cantab.).

THE patronage of the chair of Pathology now vacant in the University of Glasgow is in the hands of a Board of Curators, four of whom are appointed by the University Court, and three by the Managers of the Western Infirmary. The Curators met on Thursday, February 2; there were present:—The Principal (in the chair), Dr. Hector Cameron Dr. McVail, Mr. J. H. Dickson, Mr. James Boyd and Mr. William Ker. Instructions were given to advertise the vacancy—applications to be sent in by March 24. The new professor will be required to begin his duties on April 25.

A GRADUATES' magazine, *The Technology Review*, has just been issued by the recently organised Association of Class Secretaries of the Massachusetts Institute of Technology. It is an octavo volume of 140 pages, attractive in appearance, and well produced. The first number contains the introduction; a photograph with biographical sketch of President Crafts; articles on "The Function of the Laboratory," by Prof. Silas W. Holman; and on the "Pierce Building," by Prof. Eleazer B. Homer, the architect; reprints in fac-simile of early institute documents and letters—all in the first and more general half. The latter half, seventy pages, is given to news of the Institute, of the undergraduate and graduate classes. Plans are shown of the several floors of the new Pierce Building, of the first floor of the Rogers Building as now altered, and of the dynamo house. A good review of Prof. Holman's recent book on "Matter, Energy, Force and Work," is given by Dr. Goodwin.

THE seventh annual report of the Technical Instruction Committee of the City of Liverpool shows that the work of the Committee during the past year has been for the most part concerned with the consolidation and improvement of work previously in existence. There is reason to hope that, even before legislation takes place, means will be devised for the establishment of a satisfactory working scheme of co-ordination of all the public educational agencies of the City. The establishment of a School of Commerce—at present on a comparatively small scale it is true—by co-operation with the Liverpool Chamber of Commerce and the authorities of University College, constitutes an important development of higher commercial instruction, which, in another form, was comprised in the original scheme of the Committee. The school was started at the beginning of the winter session with very good promise of success.

THE proportion of children who should be receiving a secondary education has been variously estimated by different authorities. The Schools Inquiry Commissioners in 1868 estimated the proportion at 12·8 per thousand for boys, but made no estimate for girls. Committees working under the Welsh Intermediate Act have taken 20 per thousand (viz. 12 boys and 8 girls) as their estimate of the proportion of the population for whom provision should be made. The recent annual report of the Liverpool Technical Instruction Committee mentions that the number of Liverpool pupils attending secondary schools is approximately 7·5 per thousand of the population. The Committee point to this figure as an eloquent testimony to the deficiency which exists in Liverpool in the present provision for secondary education, and the urgent necessity for the matter to be dealt with, in the interests both of the City and of the nation, by some responsible public authority.

THE *Record of Technical and Secondary Education* refers to the constitution of the new University of London as "an event which will greatly affect the higher technical teaching of the metropolis. The Technical Education Board are giving considerable attention to the subject, and have formed a special sub-committee to report upon the matter and to frame a memorial to the Commissioners. It seems probable that the new University will give a stimulus to the development of economic and commercial teaching, and measures are likely to be taken for strengthening those subjects in the various schools and institutions of London. Commercial education hus, during the past year, been under the consideration of a special committee of the London Chamber of Commerce, and also a special sub-committee of the Technical Education Board. The last-named committee have collected a considerable amount of evidence, hnd are likely to issue their report in the course of a few weeks."

MR. S. PROUT NEWCOMBE has offered the London County Council his educational collection of natural history specimens and literature. This collection, which consists of about 21,000 objects, with a considerable number of works on natural history subjects, all classified to correspond with the examples, is at present accommodated in the Free Library of St. George's, Hanover Square. The Library Commissioners accepted the collection in May 1894, subject to the provision that they might return it at the end of four years if they were no longer able to afford it accommodation. The requirements of the library now demand additional space, and it has been found that to make the collection as useful as possible a lecture-class-room should be associated with it. The Commissioners have, therefore, availed themselves of the provision in the deed of gift, and have asked Mr. Prout Newcombe to remove the collection. The General Purposes Committee of the London County Council, who have had the offer under consideration, now recommend the Council to accept the gift.

THE will of the late Mr. Edward Austin, of Boston, Massachusetts, provides for public bequests of more than one million dollars, four hundred thousand dollars going to the Massachusetts Institute of Technology. *The Technology Review* gives the following extracts from the will referring to gifts to educational institutions. I give to Harvard College, Cambridge, 500,000 dollars, the interest upon which they will pay to needy meritorious students and teachers, to assist them in payment of their studies. To the Massachusetts Institute of Technology, I give four hundred thousand dollars, the interest to be applied as that of my bequest to Harvard College. To Radcliffe College (women's college) I give thirty thousand dollars, the interest to be in the same as that to Harvard College. To Roanoke College (Julius D. Dreher, president) I give thirty thousand dollars, on same terms as that to Harvard

College. To Tuskegee Normal and Industrial School (Booker T. Washington), I give thirty thousand dollars, on same terms as that to Harvard College. I give to bacteriological laboratory (Harvard Medical School) ten thousand dollars. Mr. Austin was one of the class of East India merchants so prosperous in the first half of this century. He was born in Portsmouth in 1803, but his childhood was spent in Boston, where also his permanent home and interests were centred.

SCIENTIFIC SERIALS.

American Journal of Mathematics, vol. xxi. No. 1, January.—Systems of revolution and their relation to conical systems in the theory of Lamé's products, by F. H. Safford. In problems requiring the solution of Laplace's equation, it is often possible (the author remarks) to obtain a solution by transferring to curvilinear coordinates, λ, μ, ν, and assuming that V is a product of three factors, *i.e.* $V = L.M.N$, where L, M, N are functions of λ, μ, ν respectively. Such an expression for V is called a Lamé's product. The problem treated is an application of a theorem due to Lord Kelvin, by means of which, from a known solution, V, of Laplace's equation in terms of coordinates corresponding to a system of mutually orthogonal surfaces, a solution may be readily deduced for a new system of surfaces obtained from the first by inversion. The theorem is used in an extended sense, so that real surfaces have been obtained from imaginary surfaces by inversions with regard to imaginary points as centres. A. Wangerin, in his "Reduction der Potential-Gleichung" (Leipzig, 1875), has discussed many of the topics considered here with the aid of elliptic functions. The use of these functions is avoided in the present paper. Wangerin states that the most general surfaces of revolution for which Lamé's products, with an extraneous factor, exist, are those whose meridian curves are obtained from the curves (got by equating the real and imaginary parts of the equation $x + ri = f(t + m)$, where f is either sn or cn) by an inversion with respect to a point on the axis of revolution. The same topics are treated by Haentzschel in his "Reduction der Potential-Gleichung" (Berlin, 1863), but he obtains surfaces of revolution of the thirty-second degree.—A. L. Baker contributes a short elementary proof of Cauchy's theorem, $W = \int dW = \int w dz$, taken around a closed curve enclosing no point where $w = \infty$ is zero.—The number is closed with a long essay (pp. 25–84), by C. L. Bouton, entitled "Invariants of the general linear differential equation and their relation to the theory of continuous groups." The titles of the chapters will indicate the line of work. Cap 1. Cockle's work ("Criticoids") and differential covariants. Cap 2. Cockle's results by Lie's methods. Cap 3. Invariants of the general linear differential equation in two variables for transformation of both variables. Cap 4. Consideration of a subgroup. Cap 5. Differential equation in canonical form (complete solution in explicit form of the problem of finding all the covariants and invariants of the equation in its canonical form (Forsyth's "Identical Covariants," &c.). The bibliographical references and the consideration of Sir J. Cockle's scattered results (the first dating from 1862) are a very useful feature of the memoir.—The pictorial accompaniment of the initial number of the new volume is a photograph, from a painting, of Prof. Simon Newcomb.

Wiedemann's Annalen der Physik und Chemie (Supplementary Number, 1898).—Mobilities of electric ions, by F. Kohlrausch. The conductivities of very dilute solutions may be theoretically determined from their concentrations by adding up the separate mobilities of the ions constituting the molecule. The author gives tables of mobilities from which the conductivities of monovalent salt solutions can be calculated down to concentrations of decinormal strength.—Kinetic theory of liquids, by C. Dieterici. It is shown that by applying the methods and data of the kinetic theory of gases, the properties of liquids may be to a large extent mathematically deduced. The size of the molecules exerts of course a great effect, and it will have to be more definitely known before the liquid theory is complete.—Magnetisation by alternating currents, by Max Wien. Toroids of soft iron wire, exposed to alternations of 128, 256, or 512 per second, provided by an alternate current siren, are not capable of following those frequencies by corresponding magnetic inductions. Eddy currents of higher periods are developed, and the soft iron becomes magnetically harder.—Reaction pressure of kathode rays, by E. Riecke. An ordinary radiometer is used to determine the reaction pressure, the vanes acting as kathodes. The pressure is proportional to the current intensity, with a current of 3×10^{-6} absolute units the pressure is 0·04 dynes per square cm.—Induction coils, by W. Hess. The discharge of an induction coil is studied by introducing a liquid condenser in parallel with the spark gap. The liquid condenser contains CS_2, and produces a Kerr effect between two crossed nicols. A strained glass plate is put between the nicols, and converts the dark field into a field of fringes. These are displaced by any fluctuation of potential, and when the displacements of a section of the fringes are photographed, a record is obtained of the whole course of the discharge. Some excellent photographs are reproduced.—Effect of Röntgen rays upon spark discharges, by H. Starke. Like ultra-violet light, Röntgen rays are capable of reducing the discharge potential between terminals upon which they impinge. But, unlike ultra-violet rays, they are indifferent as to the sign of the terminal impinged upon.—A new method of demonstrating Hertz's experiments, by J. Precht. The sections of a Hertzian resonator provided with a parabolic mirror are connected with a spark gap having a blunt kathode and a pointed anode. A steady discharge from an influence machine traverses the spark gap, and the gap is so adjusted that only a glow discharge passes. Any electromagnetic waves received by the mirror convert the glow into a shower of sparks, and at the same time the discharge potential is diminished.—Use of the coherer, by O. Behrendsen. For showing the reflection of electromagnetic waves, it is necessary to use a coherer which is not very sensitive, and to avoid single wires. The author uses a coherer made of powdered arc carbon.—Pyro-electricity and piezo-electricity, by W. Voigt. The question is raised whether the whole of the pyro-electric charge of a crystal can be described as piezo-electric, and as due to the change of volume which accompanies every change of temperature. The author shows that in tourmaline and other crystals with a singular axis, about 20 per cent. of the charge is purely pyro-electric. In the other crystals it is altogether piezo-electric.—Gliding discharge along pure glass surfaces, by M. Toepler. The length of sparks in air may be considerably extended by making them pass along glass surfaces backed by tinfoil, which is in metallic connection with one of the terminals.—Magnetisation of crystals in different directions as depending upon temperature, by Ascan Lutteroth. Faraday found that the orientation of a crystal in a magnetic field is less pronounced at higher than at lower temperatures. The author shows by experiments on various sulphates that this may or may not be true according to the choice of the axis of suspension, and explains his observations on the basis of molecular magnets.—Conduction of electricity by thin sheets of dielectrics, by W. Leick. Gutta-percha, paraffin, and sulphur show greater conductivity in thin layers than in thick layers. The conductivity depends upon the current strength, the resistance decreasing as the current increases. Gutta-percha and paraffin do not show any polarisation, but sulphur does.—Absorption of uranyl salts, by Ernst Deussen. Kundt's law of dispersion does not apply to the more easily soluble uranyl salts such as the nitrate and the chloride. But it holds for the nitrate in glycerin, and for the chloride in alcohol. In the case of the less soluble salts, such as the sulphate, acetate, and oxalate, the bands are displaced towards the red.—Effect of gases and metals upon the photographic plate, by B. von Lengyel. Hydrogen is capable of modifying silver bromide so as to give images on development. Metals which, like zinc, are capable of disengaging hydrogen from moist air, also exert an effect upon the sensitive plate. The Becquerel rays of uranium and thorium are, however, a pure radiation.—Visibility of Röntgen rays, by E. Dorn. The X-rays are not only visible to the ordinary eye, but to totally colour-blind eyes, sometimes appearing exceedingly bright, but always diffused owing to the absence of refraction. The rods of the retina are more affected by them than the cones.—A new electromagnetic string interrupter, by L. Arons. This interrupter dispenses with electromagnets, the vibrating string being attracted by a permanent magnet, which breaks the circuit by withdrawing a platinum wire attached to the string from a mercury surface. The attraction is electrodynamic. Since the self-induction of the circuit can be thus made very small, very high frequencies can be attained.